Mathematics Education and Graph Theory

Proceedings of International Seminar on Mathematics Education and Graph Theory June 9, 2014

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ON MATHEMATICS EDUCATION AND GRAPH THEORY

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MATHEMATICS EDUCATION AND GRAPH THEORY
Proceedings of International Seminar on Mathematics Education and Graph Theory

These proceedings contain the full texts of paper and talks presented in the International Seminar on Mathematics Education and Graph Theory on June 9, 2014

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PREFACE

These proceedings contain the full text of papers and talks presented in the International Seminar on Mathematics Education and Graph Theory. This seminar was held in conjunction with the International Workshop on Graph Masters. The workshop was held on June 7–8, 2014, while the seminar was on June 9, 2014. These events were organized by Islamic University of Malang (Unisma) in cooperation with Indonesian Combinatorial Society (InaCombS).

The workshop and the seminar would not have been possible without the time and energy put forth by the invited speakers. The invited speakers of the workshop were: **Mirka Miller**, University of Newcastle, Australia; **Joseph Miret**, Universitat de Lleida, Spain; **Christian Mauduit**, Institut de Mathematiques de Luminy, France; **Edy T. Baskoro**, Bandung Institute of Technology, Indonesia; **Surahmat Supangken**, Islamic University of Malang, Indonesia; **Tri Atmojo**, State University of Semarang, Indonesia; and **Purwanto**, State University of Malang, Indonesia.

The invited speakers of the seminar were: **Juddy Anne Osborn,** University of Newcastle, Australia and **Abdur Rahman As'ari**, State University of Malang, Indonesia. The seminar was held on the area of mathematics education and graph theory. The main themes of the mathematics education seminar include topics within the following areas (but not limited to): philosophy of mathematics education, curriculum development, learning methods and strategies, learning media, development of teaching material, and assessment and evaluation of learning. The main themes covered in graph theory seminar include topics within the following areas (but not limited to): degree (diameter) problems, ramsey numbers, cycles in graphs, graph labeling, dimensions of graphs, graph coloring, algorithmic graph theory, and applications of graph theory in various fields.

We would like to thank you to the invited speakers and all presenters who have submitted papers, for their valuable and inspiring presentation. A special appreciation goes to: **Surahmat Supangken**, Rector of Unisma and **Kiki Ariyanti Sugeng,** the President of InaCombS, who have made a lot of efforts to prepare this seminar.

We also do not forget to express our gratitude to Islamic University of Malang (Unisma) for providing financial support, and to the Indonesian Combinatorial Society (InaCombS) for the support. We hope that you had a great time and valuable experience during the seminar in Malang.

Malang, July 22, 2014

Editors

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Mathematics Education

PROCEEDINGS OF INTERNATIONAL SEMINAR
ON MATHEMATICS EDUCATION AND GRAPH THEORY

Theoretical (Conceptual) Articles

METACOGNITIVE AWARENESS ASPECTS IN SOLVING ALGEBRA

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Abstract

The research objective is analysing awareness aspects in solving algebra questions. The approach used in this research was descriptive quantitative and qualitative of which subject of the research was 43 students of 8th grade in SMPN 10 Malang. The instrument used to know students' response towards the metacognitif awareness aspects consisted of five instruments. Then, the results of validity test from the ten items were namely 0.68; 0.83; 0.62; 0.67; 0.71while the coefficient of reliability was 0.95. The results related to students' response the metacognitice awareness aspects had mean 2.91, additionally; the results was completed by pair interview.

Keywords: *Awareness, Metacognitive*

INTRODUCTION

Constructivist-oriented learning has three characteristics, namely: 1) students in their learning activities; 2) new information, which is imparted, is related to previous information so that it integrates with the scheme owned by the students, in order to the understanding of information can be realized well; 3) problem solving-oriented learning (Hudoyo, 2005). Through these three aspects, students are orientated to understand math more meaningful conceptually and procedurally

The experts who have developed constructivism are Jean Piaget and Vigotsky (Cholis, 2006; Nurdin, 2007), both emphasize that the cognitive changes may occur if the conception that has been understood and treated through a process to acquire new information (Norani, 2005; Cholis, 2006). This theory views students respectively check the new information which is not accordance with the old conception and fix it.

Learning based on the principles of constructivism is teachers not only impart the knowledge to the students, but also have an obligation to develop knowledge owned by the students (Cholis, 2006, In'am, 2010). Through this way, the implementation of learning activities, which orientates the information become very meaningful and relevant to the students to apply their ideas by themselves consciously as well as explore the best strategies for learning.

Concerning the explanation above, it can be said that the development of knowledge can be acquired through any interaction with the objects, phenomena, experiences and the environment in which they are located. The truth of knowledge is based on the benefit of searching the solution accordance with the problem (Noraini, 2005; Noorshah, 2006). Knowledge cannot be taken for granted from other people, but it should be interpreted in accordance with the prior knowledge they have. Knowledge is not gained instantly, but rather through a process that develops sustainably (Paul, 1997).

The characteristics of constructivist-based learning are: 1) learning can give meaning to the students which come from what they see, hear, feel, and experience; 2) the construction of meaning is a continuous process, in every finding a phenomenon the reconstruction is done sustainably; 3) learning is the development of thought as an effort to construct new knowledge; 4) the actual learning process occurs when a person's scheme is in doubt which stimulates a further thought, and it can improve the quality of learning; and 5) learning outcomes are influenced by the learning experiences owned by the students and their environment (Paul, 1997). It is also said that learning is students' activity in

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searching for the meaning from what they learn through the adjustment of concepts and new ideas with the existing framework and students' framework (Shymansky, 1992; Nurdin, 2007).

LITERATURE REVIEW

Thinking is a process of using mind, in an attempt to find meaning and understanding something, make judgments or decisions as well as solve a problem (Noraini, 2005; Poh, 2006; Tall, 1994)), it is also said that by the formation of concepts, searching the causes or making the determination (Beyer, 1991). One of thinking knowledge, which can be used, is metacognitive treatment (Kirsh, 2004; Fortunato, 1991).

Metacognitive is thinking about thought (Flavell, 1979), is thinking how to think or learning how to learn (Blakey & Spence, 1990), and this is as a strategy to solve the problem (O'Neil & Brown, 1997). Martinez (1998) explains that in solving problems it needs to be aware of what is done, what strategies used and the effectiveness of these strategies.

According to O'Neil & Abedi (1996) metacognitive consists of four aspects, namely: 1) awareness; 2) cognitive strategies; 3) planning; and 4) self-monitoring, and in this research one metacognitive aspect, which is awareness aspect is studied. A person who is carrying out the activity will work properly if he understands and acknowledges the awareness of himself and a series of activities to be carried out. Awareness as one of the metacognitive aspects is an aspect related to awareness of thinking what he does, including the strategies used in thinking (Fernadez, 2000; Jeni, 2004). Next, realizing the process of thinking occurs to devise the actions to be performed in order to be able to understand the problems faced.

METHOD

The approach used in this research was descriptive quantitative and qualitative. The subject in this research was 8th grade students of SMP 10 Malang amounted 43 students. Data were collected through the instrument consisting of five items of metacognitive awareness aspects. The instrument used firstly tested for validity and reliability in 8th grade towards the students who were not the subject of the research. The results of instrument validity were 0.68; 0.83; 0.62; 0.67; 0.7, while the reliability has coefficient of 0.95.

Data analysis was conducted by describing data collected with the frequencies, the means and the percentages for each scoring then described the overall mean. To complete the results of the quantitative analysis, it was presented that the results of interviews acquired through pair interviews by taking 6 students which were classified into three groups; one group of those who had good ability, another group of those who had fair ability and one more group including those who had deficient ability.

RESULT

Based on the collected data, students' response towards the metacognitive awareness aspects could be classified into two, namely the students who realized about themselves related to the problems faced consisting of based on a good response and an excellent one, and a group of students who were less aware of themselves related to their problems consisting of based on a simple response and a weak one.

The mean of the lowest response is 2.72, at the items about the awareness of the way of thinking, and in this instrument item, the awareness showed the lowest response compared with other items. This statement has the majority of responses at the 'good' category, with the frequency and the percentage of 25 (58.14%), while for the simple category had the frequency and the percentage of 12 (27.91%). This means that the items related to students' awareness about the way students think categorized as good, though the mean based on this item is at 2.72.

Next is students' awareness to understand the problem before attempting to solve it, with the mean score is 2.88. This response mostly is categorized into good,

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with the frequency and percentage of 16 (37.21%). Meanwhile, for the simple category is 13 (30.23%), and it is greater compared to excellent category that has the frequency and the percentage of 12 (27.91%). This situation shows that students' awareness in understanding the problem before attempting to solve the problems tend to the intermediate category, which is between good and simple category. Nevertheless, based on metacognitive category, this item is categorized as good.

Regarding the students' awareness before using their mind to solve the problems and the awareness for devising the action before trying to solve the problems have the same mean, which are 2.95. These both items mostly included into good category with the mean of the frequency and the percentage of both are 21 (48.83%). Meanwhile, simple and good categories of which frequencies are almost the same, and the mean based on both categories is 10.5 with the percentage of 24.42%. Like other items, the mean of both items provide the information that these items are categorized as good.

In general, students realized in understanding and solving problems, it is shown by the mean of the frequency and the percentage is 30.4 (70.70%), and only 12.6 (29.30%) students are less aware of the problems to be solved. By researching the mean of the highest response of 3.05 and the lowest one of 2.72 and the mean of overall response of 2.91 as well as based on the category of metacognitive treatment, it can be said that the mean of related response included into good category. This means that students generally realize their way of thinking in solving problems.

The results stated above are complemented by interviews with the students, which provided the information that the awareness aspect in solving algebra problems have been owned by the students; either those categorized as good or fair. As indicated in the conversation stated in the transcript, students said about the steps undertaken, they were "... *Find the sides which are not given,.. the sides which do not have variables, let's say y and* another one is *z*" (P1/T1/21-22). It shows that the students realize the way to find the components which are not given, i.e. by giving the variables y and z.

Besides, the students also said that to solve the first problem, it was said ".. *Find the value of z, ... equal to (*x *+4*) *subtracted (*x *+1*) *equal to x subtracted x* added *4* subtracted *1 equal to 3 ... now we find the perimeters, ... (*2x *+3*) added *(*x *+1*) added *(*x *+4*) added *(*x *+1*) added *3 added (*x *+ 2*) *(*together with another *student*" *(*P1/T1/32-*38*).

Based on the transcript of related interviews, the acquired information is that the students had awareness of how they want to seek the perimeters of given 2D shape. Students understood, that the perimeters based on given 2D shape was acquired through the sum based on the sides which form the 2D shape of which the perimeters to be found. Besides, the acquired information is that students in solving the questions using the procedure of forward thinking, which was problem-solving based on what was given, then, thinking various ways to reach what was asked, even by attempting. Some steps are: a) identifying what is given and what is asked in question; b) thinking of a formula or a way that may relate to what is given and asked; and c) selecting a formula or a memorable way to resolve the problem.

Similarly, the transcript of the interview from another group of students said that "*the sides which do not have variables* let's say *a and another one is b*" (P2/T2/22). The graphs of which the perimeters and the areas to be found, actually there are two sides are not given, but can be acquired by performing subtraction operation on the given sides, so that all sides have length in x.

Based on the transcript of related interview, the acquired information is that the students' activities in solving problems using deductive thinking procedure, which is the problem solving begins based on something common to gain something special. Some steps are carried out: a) identifying something given and asked in the question; b) selecting the formula, characteristics, or requirements based on a principle which associates something given

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with something questioned; c) the substitution of something given into the formula to acquire the answers from what is questioned.

Based on interviews with the students, it was said that "the *sides which are not* given called *y and z, where y is equal to 2x +3 subtracted x +1 while z is equal to x +4* subtracted *x +1*" (P1/T1/23-25). This situation showed that the students are aware what should be done before solving the problem which finds the perimeters based on the related graph.

The steps should be taken to acquire the perimeters and the areas of related 2D shape. It is necessary to search two sides which are not given yet, as what students said "... the *sides which do not have variables let's say y and* another one is *z*" (P1/T1/21-22). Next, the steps should be done to acquire the perimeters and the areas of related 2D shape, "now *we are looking for the perimeters, ... (*2x *+3*) *added (*x *+1*) *added (*x *+4*) *added (*x *+1*) *added 3 added (*x *+2*)" (P1/T1/35-38). The results acquired perpetuate that the students are aware of the necessity to devise actions to be done and also know what would be done and devise it before accomplishing the solution of question.

However, for the students categorized as simple ability, their awareness aspects based on metacognitive had less understanding in problem solving. This situation is as shown in the results based on interview ... "yeaah ... *x +1 added 2x +3 added x+4 added x +1 .. added ... how is it ... can be ... divided by 2 ... ehhh ... 2x +3* subtracted *x +1* .., let's say *y for this one and z for another one ..*" (P4/T4/22-26). Similarly, for the group of students included in weak category, it was found that the results of interview "..it *means x +1 added 2x+3 added* x+4 added x +1 .. added ... *lho ..... how is it ... like this...divided two...no it's not.... 2x+3 subtracted x +1 .., just call these y and z* .." (P6/T6/23-28).

Based on the findings, the acquired information is that the respondents is fooled for a moment by the graph seen, they presumes that the side which is not given can be found by dividing the two sides given. However, it does not take a long time that they are aware that previous statement is wrong. Furthermore, they said that the side, which was not given can be found by subtracting the sides given like in the transcript of related interview. This situation shows that the students in the deficient group also have awareness of how to think and search the solution of question, but their awareness is rather late.

DISCUSSION

The results show that students' metacognitive awareness aspects in solving the problem can be classified into two groups. First, good and fair groups have awareness before accomplishing algebra problems. This condition is relevant to the results of research conducted by Noorshah (2004) concerning the metacognitive treatment in solving the problem of sum. The study of metacognitive awareness aspects also studied in depth (Fernadesz, 2000) and the results are also relevant to the results of this research.

CONCLUSION

Students categorized into good and fair groups have awareness before solving the problems. It is seen from the mean of their responses is included into good category. This situation is enforced by the results of pair interview conducted in solving algebra problems. Meanwhile, the students categorized deficient, their metacognitive awareness aspects can be said rather lacking, but it does not take a long time for them to be able to realize the mistakes, that the previous statement is wrong and immediately can notice it.

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